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Video Surveillance System Usage in Preventing Crime: Preliminary findings from Malaysia

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Abstract

The preliminary study focuses on two key aspects of crime prevention via Video Surveillance Systems (VSS) and the specific context of VSS deployment in Malaysia. The study employs interviews as a method of data collection and a thematic content analysis approach to data analysis. The research findings highlight the VSS's effectiveness in solving crime cases, satisfaction among participants using VSS, limited expertise and skills in video analysis, and the high costs associated with the installation. Future studies should delve deeper into the regional impacts of video surveillance on crime rates in Malaysia and investigate the integration of emerging technologies' effectiveness.

Keywords: video surveillance system, video surveillance content, CCTV, crime prevention

1.0 Introduction

Video surveillance systems (VSS) are progressively showing a high demand (Elharrouss, Almaadeed, and Al-Maadeed, 2021). Countries all over the world have used CCTV surveillance to a large extent. The United Kingdom, for example, is still one of the most heavily monitored countries in the world, with over 5 million CCTV cameras watching over its citizens (Alabi, Balogun & Adeleye (2021). Over 200 million cameras are installed on Chinese citizens to follow their every move and assist law enforcement in solving crimes. The United Kingdom is a world leader in using CCTV, and citizens are accustomed to seeing cameras on nearly every high street. Although such systems continue to get widespread public approval, they involve intrusion into ordinary people's lives as they go about their daily lives, raising privacy issues (Almeida, Shmarko, and Lomas (2022).

In Malaysia, the Selangor government seeks to install 5,000 closed-circuit (CCTV) cameras in many critical areas and crime hotspots around the state as Malaysia approaches 2020 (Ramli, 2021). The surveillance program will include a cutting-edge facial recognition system linked directly to a command centre and used as a security tool to help the state reduce crime. Malaysia progressively began deploying video surveillance in public locations in the 1990s, according to a report by the Malaysian Communications and Multimedia Commission (MCMC), with Kuala Lumpur City Hall (DBKL) installing cameras throughout the nation's capital to monitor traffic in the city center (Wahab, 2021; Ramli, 2021). More than a decade later, video surveillance devices are the norm everywhere we walk, stationed

at nearly every street corner, lamp post, and street light, and are constantly lauded as a vital and effective means of preventing crime and ensuring public security.

The camera's goal is to dissuade destructive behaviours, and the video footage can also be used as evidence for security or law enforcement to evaluate later. Surveillance cameras can be visible or hidden in plain sight. A network of cameras, monitors/display units, and recorders comprise a video surveillance system. It functions 24 hours a day, seven days a week, whether inside or outside the structure and is only used to record movement when required. Cameras can be analogue or digital, and there are a variety of qualities to investigate, including resolution, frame rate, colour type, and more.

According to Malaysia's crime rate data from 2019 to 2021, most developing states in Malaysia have a higher rate of crimes, such as Kuala Lumpur, Selangor, and Melaka for each consecutive year. An effective VSS should be competent in capturing motion-based images and effective in network transmission, video analysis, storage capabilities, and archiving options. Rapid increments in video content production and collection should be tracked on quality measures for better utilization in crime prevention. Nevertheless, scanty proof revealed the effectiveness of video surveillance in Malaysia, especially in crime prevention.

Hence, the research aims to disclose the practical measures of VSS in preventing crime in public areas in Malaysia, especially in high-crime rate cities. The article reveals the preliminary study result on current practices of authority officers in Malaysia, especially the Police department, in the usage of CCTV video as a tool in crime prevention.

2.0 Literature Review

In an era where public safety remains a paramount concern, using video surveillance systems has garnered significant attention as a potential tool for reducing criminal activities. This review critically assesses the efficacy of video surveillance in curbing crime rates, drawing from a range of scholarly sources to offer an informed perspective on its benefits and limitations.

2.1 Video Surveillance System

Video surveillance is a tool that integrates the functionality of real-time cameras or closed-circuit Television (CCTV) and other components for managing safety and security within public spaces (Diard, 2018; Collins et al., 2000). Basic video surveillance systems comprise of interconnection between cameras via wireless video servers to PCs or mobile devices. Prior common functionalities such as motion detection capabilities and warning prompts showed limited push for video surveillance technology advancement (Haering et al., 2008). Video surveillance systems have evolved and integrated with more advanced technology, such as real object detection, biometrics sensors, and facial recognition (Piza et al., 2019). The deployment of video surveillance by personnel, communities, organizations, government bodies, or even countries started more than 30 years ago, and the pool of video information overloaded in the CCV has just been abandoned and overlapped at any point in time scheduled.

Fundamental shifts in how digital data is gathered, analyzed, shared, and stored have changed the capabilities of video surveillance systems during the last decade. Security cameras have significantly impacted the innovative city movement and the emerging industrial Internet of Things (Shorfuzzaman et al., 2021). As cameras become more capable of gathering data and making predictions based on integrated analytical software developed by manufacturers, deep learning and Artificial Intelligence (AI) are becoming more common. In both private and public sectors, many countries increasingly use public video surveillance as a primary tool to monitor population movements and prevent crime and terrorism.

Various video surveillance systems are available, including live monitoring, remote access via an IP system, and digital video recorders (DVRs) for recording footage, depending on your needs. Research into intelligent-based surveillance systems is becoming increasingly crucial for disaster and crime prevention and industrial and public security protection (Sung & Park, 2021).

2.2 Crime prevention Via Video surveillance systems

In crime investigation, CCTV footage is an essential source of evidence to investigate criminal offences (Morgan & Dowling, 2019). Piza (2018) articulates the past literature confirming the effective and significant use of CCTV footage in crime reduction (Alexandrie, 2017; Welsh and Farrington, 2009; Welsh and Farrington, 2002). According to Clarke and Homel's (1997) classification of situational crime prevention, CCTV is viewed as a technique of" formal surveillance." nowadays, CCTV and other modern technologists are used to support the traditional measures of situational crime prevention (Aransiola and Ceccato, 2020). In this regard, CCTV cameras are seen to enhance or replace security personnel. In their studies, Piza et. al., (2019) reviewed CCTV surveillance used for crime prevention and concluded that CCTV is associated with significant and modest decreases in crime.

According to situational crime prevention concepts, CCTV surveillance has become more evident, and it is now a standard to deter criminal behavior. The importance of CCTV surveillance can be found in the context of a person-situation interaction in criminal behavior. The environment is not merely a backdrop to criminal behavior; it frequently plays a crucial role in its beginning and progression. Table 1 shows Video Surveillance System Features in Crime Prevention.

Table 1. AVideo Surveillance System Features in Crime Prevention

Authors/ year	Country	Video SS features and technology-based	Recommendations
Alabi, Balogun & Adeleye (2021)	Lagos, Nigeria	Pan, Tilt, and Zoom flexible cameras that are randomly distributed with a well-coded centralized control system are recommended for effective surveillance.	Combination use of physical patrolling and use of sensors-based surveillance system should also be encouraged.

Laufs & Borrion (2021)	London, UK	Surveillance-oriented security technologies (SOSTs), which refer to all technological solutions should be strategies with flexible and conducive to (technological) innovation, and interoperability between systems and minimize disruptions in day-to-day operations.	Focus more on practitioner perspectives and operational and practical issues. The social acceptability level of individual interventions also needs to be evaluated.
Sung & Park (2021)	Korea	We are applying deep learning technology model in designing an intelligent surveillance system that can quickly and effectively detect crimes by sending a video image and notification message to the web through real-time processing.	Enhance deep learning technology applications securing suitable architecture for video surveillance. Infrastructure that suits the purpose, use, and cost of designing video surveillance systems.
O'Malley & Smith (2021)	Australia	Enhanced vision CCTV cameras (with video analytics), algorithmically driven geofencing software, and improved LED street lighting. Police can extract the footage and mapped with their facial recognition system (Neoface) for evident findings.	Real-time public dashboard which would integrate and illustrate different temporalities and spatialities of criminal justice processes.
Khan et al. (2020)	Dhaka, Bangladesh.	High-quality CCTV images can help police personnel to get images for such analysis. The use of some additional features and devices like microphones and loudspeakers together with CCTV and other technological instruments may enhance the probability of controlling crime in a significant way.	It is recommended that the existing installation and maintenance of the system should be replaced with an adequately audited demand for CCTV operations. A wireless networking mechanism incorporating advanced options like facial recognition and artificial intelligence needs to be developed.
Circo & McGarrell (2020)	Detroit, Michigan, USA	CCTV surveillance is being integrated with proactive monitoring and police response. DPD established a real-time crime center (RTCC) that allowed crime analysts to evaluate surveillance footage in real-time. Business owners purchased high-definition surveillance cameras, lighting, and signage that identified their locations.	The relationship between integrated CCTV camera systems and attitudes toward the police remains largely unexplored.
Soh and Ahmad (2019)	Malaysia	From the STEEPV analysis, the researcher found CCTV technology such as face recognition, Smart hub features, and Reaction detectors able to make the school environment safe and under control.	Critical of CCTV surveillance system implemented in Malaysia schools for a secure and safe education environment
Almeida, Shmarko, and Lomas (2022)	United States (USA), United Kingdom (UK), and European Union (EU)	12 national police forces had already deployed facial recognition with 7 more planning or testing deployments at that date. Deployment has been deemed to be much slower than in the USA. The scenario may be because it is surrounded by more suitable, uniform legislation, greater transparency, and active data protection authorities.	The data protection impact assessments (DPIA) and human rights impact assessments with greater transparency, regulation, audit, and explanation of Facial recognition technology (FRT) use, and application are essential to improve FRT deployment.
Arsyi Lajimin and Kanyo (2021)	Sabah, Malaysia	The Safe City concept was introduced in Malaysia in 2004. CCTV adoption in business and public areas is part of the strategy in the Safe City Concept under the Empowering the Target Area. The study's findings show all women's respondents ultimately agreed on the CCTV deployment.	The deployment of CCTV to target areas should be emphasized to all target areas in Sabah's districts. Cooperation from the central and state governments, companies, NGOs, and society should also be united to curb the crime rate.

The research gap identified from the literature reviews is the need for more proof of the effectiveness of VSS usage, particularly in the context of security and crime prevention. Key areas for further exploration include physical patrolling and sensor-based surveillance, focusing on practical issues and practitioner perspectives. The need to assess VSS's social acceptability should also be empirically tested in terms of social privacy, believability, and human rights impact. Additionally, there is a call for Malaysian practitioners and researchers to accelerate criminal justice processes and establish proper audit mechanisms for CCTV operations to measure the effectiveness of VSS usage. Less research also reveals the importance of CCTV surveillance implementation in specified locations or organizations in Malaysia, such as in educational environments and commercial or rural areas. The underlying technology employed in the Video Surveillance System (VSS) should be scrutinized, considering its capabilities, return on investment (ROI), and expertise in effectively addressing and reducing crime rates.

2.3 Video Surveillance Systems in Malaysia

Malaysia progressively began deploying video surveillance in public locations in the 1990s, according to a report by the Malaysian Communications and Multimedia Commission (MCMC), with Kuala Lumpur City Hall (DBKL) installing cameras throughout the nation's capital to monitor traffic in the city center. More than a decade later, video surveillance devices are the norm everywhere we walk, stationed at nearly every street corner, lamp post, and street light, and are constantly lauded as a vital and effective means of preventing crime and ensuring public security.

Under the Safe City Concept which was introduced in Malaysia in 2014, the utilization of CCTV is the 9th step out of 15 Steps of the Safe City Program. The Town and Country Planning Department introduced the Safe City program in 2010. One study done in Kota Kinabalu, Sabah, on the deployment of CCTV in businesses and open targeted areas, is crucial for society, especially women, to feel safe from criminal acts in public spaces(Arsyi Lajimin and Kanyo, 2021).

In 2021, the Smart City Handbook Malaysia included the Smart Living Pillar. One of the programs is the Safe City Programme, which includes the initiative of installing and upgrading smart CCTV cameras across the Kuala Lumpur city, integrated with video analytics-enabled software. The video footages are integrated into the command center to enhance the monitoring process for crime prevention, traffic, and flash floods (Ministry of Housing and Local Government Malaysia, 2021). Here, the capabilities of video technology and data can be measured in the implementation of Malaysian Cities.

Under the Smart Digital Infrastructure component, CCTV analytics analyze situations live using intelligent camera systems integrated with a central data platform, feed, and forensic Analytics capabilities. In the smart Selangor Safe City concept, Selangor aimed for a violent crime rate reduction by 50% from 2020 as 2025 Success Indicators (Smart Selangor Delivery Unit (SSDU), 2020).

Deployment of CCTV as video surveillance in preventing crime has been monitored and proven. In the 2020-2021 period, the Malaysian Crime Index (IJM) decreased and aligned with an increase in The Malaysian Perception of Security Index (PSI) (Mohamad Hashim et al., 2022). Through the same study, surveillance through CCTV has been recommended for increasing the PSI in crime prevention. CCTV video surveillance usage should be leveraged nationwide to monitor the country's border to prevent physical intruders and drug smuggling activities. High-quality video and high-end technology of CCTV usage have also been recommended to be enforced legally in commercial buildings and residents to increase safety and reduce crime rates in their area.

Countries all over the world have used CCTV surveillance to a large extent. The United Kingdom, for example, is still one of the most heavily monitored countries in the world, with over 5 million CCTV cameras watching over its citizens. Over 200 million cameras are installed on Chinese citizens to follow their every move and assist law enforcement in solving crimes. The United Kingdom is a world leader in using CCTV, and citizens are accustomed to seeing cameras on nearly every high street. Although such systems continue to get widespread public approval, they involve intrusion into ordinary people's lives as they go about their daily lives, raising privacy issues.

3.0 Methodology

This study adopts a case study where it started with the preliminary study aimed to identify issues on VSS usage in crime prevention which is possible to have various arising issues. A literature review was conducted using the keywords video surveillance, video surveillance and crime prevention, and video surveillance usage in crime prevention. Based on the findings of the issues of VSS in the literature, the next procedure followed the guided interview method. This method was conducted to explore and validate the current implementation and thoughts of police officers toward the issues that have been identified. Twenty-six police officers were interviewed as participants to get their opinions, views, and thoughts on VSS usage and video surveillance content handling in their workplace. The inclusion criteria were the police officers who have more than three years of experience in any police department and had no experience or exposure to crime cases that involved managing pieces of evidence. In terms of the number of participants involved, an adequate sample size is achieved and the findings already reaching a point of data where new information or themes are no longer emerging (Creswell & Creswell, 2018; Dworkin, 2012).

The interview findings were analysed using a thematic content analysis approach, which was analyzed into six (6) primary themes: VSS involvement, VSS Content management, VSS analysis, VSS & and crime investigation, acceptance of VSS, and VSS and monetization. Several studies have used the same method (Aldhaheri and Xia, 2022; Leitão, 2019) and analyzed the data using a thematic content analysis approach.

4.0 Findings and Discussions

Video surveillance systems or CCTV deployment in criminal investigations is agreeable and accommodating. There were unified claims by the participants that such recorded footage serves as valuable evidence for identifying suspects, establishing timelines, and reconstructing events. Almost all participants were involved with video surveillance content in seeking evidentiary value and supporting their investigation process. This practice is aligned with police departments in other countries (Laufs and Borrion, 2021; Shorfuzzaman, Hossain, and Alhamid,2021; Sung and Park, 2021; Piza et al.,2019).

Video surveillance has become increasingly prevalent in urban environments, transportation hubs, and commercial spaces. Proponents argue that the mere presence of surveillance cameras can deter criminal behaviours by creating a sense of constant observation. However, there is a lack of guidance and procedure for data collection and management of surveillance evidentiary data for police officers' conduct or vulnerable parties. Connon et al. (2023) repeatedly highlighted in their review the absence of guidance or integration of technology skills potentially effective for specific crimes either for video surveillance technology or other emerging technology adoption in policing practices. The review also aligns with the preliminary finding about the lack of video surveillance handling

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and management. Negligence of proper guidelines on managing the surveillance evidence data will increase privacy issues and lead to inefficiency in solving the cases (Lavorgna and Ugwudike, 2021; Piza et al. 2019).

Another fact revealed that most of the participants needed to gain knowledge in the analysis of video surveillance content. In their practices, all the digital footage or video content that needs to be investigated will be sent to the forensic department. Ordinary police officers in other departments and state branches focus on the physical investigation process. Video content analysis, such as motion detection, object tracking, object detection, individual interactions, and behaviour management are crucial, however among participants were still limited in skills and specialists in those video analysis practices (Elharrouss et al., 2021; Sung & Park (2021).

In terms of acceptance of VSS and its effectiveness in crime investigation, the majority of uniform answers gathered were satisfied with the effectiveness of VSS in handling criminal cases. Most of the video surveillance content was used in the prosecution process in the courts and was able to solve crime cases (Zhang, D., An, P., & Zhang, H., 2018). Only a few of the respondents felt unsatisfied with the VSS deployments and related to the quality of video content. The application and effectiveness of VSS in crime investigation and court prosecution have already been agreeable (Anderez et al., 2021; Circo & McGarrell, 2020). Khan et al. (2020) stated that high-end VSS can facilitate police to do video analysis with the capability of embedded features such as facial recognition and artificial intelligence.

No doubt, VSS deployment in crime surveillance and policing work environments facing advanced technology limited budget. Anderez et al. 2021 made a cost comparison between cloud-based systems and edge computing, which is more computationally powerful in the small gadget. Regarding cost, they claimed data processing using each smart device is cheaper and more affordable when related to the product price and demand theory. Proper evaluation of costs and benefits could be done thoroughly to leverage the use of any emerging technology before its deployment (Connon et al., 2023).

4.0 Conclusions and Future Directions

In conclusion, the preliminary study has shed light on the role of video surveillance systems in crime prevention, specifically focusing on their implementation in Malaysia. The findings suggest that video surveillance systems can effectively deter and reduce criminal activities. However, several challenges still need to be addressed, including limited expertise in video analysis and the high costs associated with these systems. To enhance the effectiveness of video surveillance in crime prevention, stakeholders in Malaysia must invest in developing the necessary skills and expertise in video analysis. Additionally, efforts should be made to explore cost-effective solutions and strategies for deploying and maintaining these systems.

Future studies in this area should further investigate the specific impacts of video surveillance on crime rates in different regions of Malaysia. Additionally, research can explore innovative ways to harness the potential of emerging technologies, such as artificial intelligence and machine learning, to improve the efficiency and accuracy of video analysis in crime prevention efforts. By addressing these challenges and considering these recommendations, Malaysia can continue to harness the benefits of video surveillance systems in enhancing public safety and reducing criminal activities.

Acknowledgments

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